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CONDITION OF HEMODYNAMICS IN THE PULMONARY CIRCULATION OF PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) CONCURRENT WITH METABOLIC SYNDROME WITH HYPERTROPHY AND ATROPHY OF THE MYOCARDIUM

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ABSTRACT

Introduction: In recent years, COPD is observed as not an isolated, but an associated pathology, in particular, concurrent with metabolic syndrome.

The aim of the research is to identify the differences in changes of the rheopulmonography parameters (RPG) depending on the presence of hypertrophy or atrophy of the right ventricular myocardium in patients with COPD concurrent with metabolic syndrome.

Materials and methods: We studied changes in rheopulmonography (RPG) in 145 patients with chronic obstructive pulmonary disease (COPD) concurrent with metabolic syndrome.

Results: We detected precapillary hypertension of the pulmonary circulation in patients with right ventricular myocardial hypertrophy: anacrotism serration; flattened peak of the systolic wave; decreased Vcp; high placement of incisura; horizontal course of catacrotism; decreased amplitude of the systolic wave (in this case, due to a greater increase in the resistance of the blood flow in the pulmonary vessels than the decreased impact volume of the right ventricle); prolonged Q-a (in this group of patients, it depends more on hypertension of the pulmonary circulation than on the reduction of contractile function of the myocardium).

In atrophy of the right ventricular myocardium, the following changes in the RPG were revealed: decreased systolic wave at its dramatic rise; prolonged Q-a (in this case, due to the weakened heart contraction); Vmax reduction (it reflects the reduction of myocardial contractility); in hypertrophy of the myocardium, Vcp, unlike RPG, does not decrease, which is explained by the decrease in the pressure of the pulmonary circulation.

Conclusions: We believe that these changes in RPG allow differentiating hypertrophy and right ventricular myocardial atrophy along with established diagnostic criteria, and can be used as markers for the diagnosis and treatment of COPD concurrent with metabolic syndrome.

KEY WORDS: chronic obstructive pulmonary disease, metabolic syndrome, rheopulmonography, myocardial hypertrophy, myocardial atrophy

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INTRODUCTION

In recent years, there has been an increase in the specific weight of morbidity and mortality of the population caused by chronic obstructive pulmonary disease (COPD). This is due to a number of causes: pollution of the air pool, smoking, bacterial flora resistance to some antibiotics [1,2]. Chronic obstructive pulmonary disease (COPD) is an example of a multifactorial illness, which involves many factors [3-6]. In a significant number of cases, COPD development is preceded by acute bronchitis and pneumonia, which tend to the prolonged course. Patients with COPD account for 2.5-3% of the total population, and mortality from this pathology constitutes 20-40% of all deaths from circulatory failure [7-8]. The incidence of chronic bronchitis in various regions of Ukraine reaches 3-11%, and in hazardous industrial and agricultural production - 15-50%, with 25-30% of patients suffering from the obstructive form of the disease.

Pulmonary heart disease (PHD) is characterized by the staged development. At the first stage, one can observe

a restructuring process at the level of the external respiration apparatus with subsequent respiratory failure; at the second stage – pulmonary hypertension (PH), changes of central and peripheral hemodynamics are joined. At the third stage, an increase in the minute volume of the heart is characteristic against the background of already changed contractile function of the myocardium and at the fourth one, right ventricular heart failure is observed.

PH is the main manifestation of hemodynamic impairment of the pulmonary circle COPD. It leads to overload and (or) dilation of the right ventricle, which subsequently plays an important role in the occurrence of circulatory insufficiency by the right ventricular type. The main causes for the development of LH are increased pulmonary vascular resistance and decreased lumina of the vessels of the lungs as a result of hypoxia.

However, it should be noted that the pulmonary pathology, including chronic pulmonary heart, has not been sufficiently studied in all aspects. In addition, in recent years, scientists have focused on COPD as not an isolated

Table I. Reopulmonography parameters in patients with COPD concurrent with metabolic syndrome

Parameters	Healthy people n=16	Patients with COPD concurrent with metabolic syndrome in whom the following was detected:			
		Hypertrophy of the myocardium n=68	P	Atrophy of the myocardium n=77	P
Amplitude of the systolic wave (Ohm)	0.291±0.025	0.126±0.018	<5%	0.103±0.022	<5%
Amplitude of the diastolic wave (Ohm)	0.163±0.034	0.089±0.012	<5%	0.059±0.015	<5%
Right ventricular tension period (sec)	0.115±0.023	0.212±0.018	<5%	0.173±0.019	<5%
Time of maximum systolic filling (sec)	0.165±0.021	0.289±0.024	<5%	0.185±0.018	>5%
Time of rapid blood filling (sec)	0.082±0.240	0.109±0.017	>5%	0.119±0.014	>5%
Time of slow blood filling (sec)	0.119±0.015	0.169±0.012	<5%	0.072±0.022	>5%
The maximum speed of rapid blood filling (Vmax) (Ohm / sec)	1.76 ±0.210	0.21.410±0.120	>5%	1.080.940±0.120	<5%
The average speed of slow blood filling (Vcp.) (Ohm / sec)	0.46 ±0.060	0.17 ±0.032	<5%	0.390±0.021	>5%

Note: P indicates reliability with respect to the corresponding group

disease, but a combined pathology. In particular, the combination of COPD with metabolic syndrome, has come to the forefront of research [9,10].

Rheopulmonography is one of the research methods (both safe and economically beneficial), allowing to assess the state of hemodynamics in the pulmonary circulation.

THE AIM

The aim of the research is to identify the differences in changes of the rheopulmonography parameters (RPG) depending on the presence of hypertrophy or atrophy of the right ventricular myocardium in patients with COPD concurrent with metabolic syndrome.

MATERIALS AND METHODS

Changes of RPG were studied in 145 patients with chronic obstructive pulmonary disease (COPD) concurrent with metabolic syndrome.

We determined the nosological form of COPD and metabolic syndrome according to WHO criteria. The stage of circulatory failure was evaluated in accordance with the classification by N.D. Strazhesko and V.Kh. Vasylenko. The diagnosis of COPD and metabolic syndrome was made on the basis of anamnestic, clinical, biochemical and instrumental data, obtained during the examination of patients. The study group consisted of patients with at least one main type of obesity (central (abdominal) - waist circumference of more than 80 cm in women and more than 94 cm in men and / or increased body mass index of more than 30) and two additional criteria of metabolic syndrome (arterial hypertension AH>140 / 90mm Hg), increased triglyceride levels>1.7 mmol / l, decreased HDL cholesterol levels<1.0 mmol / l in men; <1.2 mmol / l in women, increased LDL cholesterol>3.0 mmol / l, fasting hyperglycemia (fasting blood glucose> 6.1 mmol / l), impaired glucose tolerance - glucose in the blood plasma 2 hours after the glucose tolerance test within> 7.8 and <11.1 mmol / l). The diagnosis of hypertrophy and atrophy of the right ventricular myocardium was made on the basis of

echocardiography and electrocardiogram analysis.

For rheopulmonography, rheograph P4-02 was used, with the recording device - electrocardiograph ELCAR-6 and diagnostic automated complex "Cardio +". Zonal rheopulmonography was performed according to standard methodology (Zhukovsky L.I., Frinerman E.A. [11])

The reliability of difference in the comparable average values was determined by the Student's t-criterion. At the same time, the difference was considered reliable at $t \geq 2.0$, which corresponded to the probability of an error-free prediction equal to 95% or more ($p \geq 95\%$).

Before launching the study, all patients signed an informed consent to participate in the study, in accordance with the requirements of Helsinki Declaration as of 1975 and the Order of the Ministry of Public Health of Ukraine No. 690 as of September 23, 2009, "On Approval of the Procedure for Conducting Clinical Trials of Medicines and Examination of Materials for Clinical Trials" and "Typical Provision on the Ethics Commission". The ethical, moral and legal aspects of the study have been agreed with the Bioethics Commission of Ukrainian Medical Stomatological Academy.

RESULTS AND DISCUSSION

Considering the changes in pulmonary blood flow in these groups of patients, we revealed the difference in RPG changes in patients with COPD with hypertrophy and atrophy of the right ventricle myocardium. Different indices were characteristic for these groups of patients (Table I).

Thus, while studying the changes in rheopulmonogram in patients with hypertrophy of the right ventricular myocardium, we revealed precapillary hypertension of the pulmonary circulation, which is manifested by the following symptoms:

- anacrotism serration;
- flattened peak of the systolic wave;
- decreased Vcp.
- high placement of incisura;
- horizontal course of catacrotism;

- decreased amplitude of the systolic wave (in this case, due to a greater increase in the resistance of the blood flow in the pulmonary vessels than the decreased impact volume of the right ventricle);
- prolonged Q-a (in this group of patients, it depends more on hypertension of the pulmonary circulation than on the reduction of contractile function of the myocardium).

In atrophy of the right ventricular myocardium, the following changes in the RPG were revealed:

- decreased systolic wave at its dramatic rise;
- prolonged Q-a (in this case, due to the weakened heart contraction);
- Vmax reduction (it reflects the reduction of myocardial contractility);
- in hypertrophy of the myocardium, Vcp., unlike RPG, does not decrease, which is explained by the decrease in the pressure of the pulmonary circulation.

Our data suggest that hypertrophy and atrophy of the myocardium in patients with COPD are combined with different changes in rheopulmonogram. This allows us to interpret the identified RPG changes as characteristic of hypertrophy and atrophy of the right ventricular myocardium in the groups under consideration. It is possible to study the dynamics of RPG changes in patients with COPD concurrent with metabolic syndrome in further more broad and differentiated research.

CONCLUSIONS

We believe that the detected changes in RPG allow differentiating hypertrophy and right ventricular myocardial atrophy along with established diagnostic criteria and can be used as markers for the diagnosis and treatment of COPD concurrent with metabolic syndrome.

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Authors' contributions:

According to the order of the Authorship.

Conflict of interest:

The Authors declare no conflict of interest.

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